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Research Article

Beyond urban boundaries: the invasive ant *Wasmannia auropunctata* (Roger, 1863) (Hymenoptera, Formicidae) now reaching Iberian coastal habitats

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Abstract

The little fire ant (*Wasmannia auropunctata*), notable for its minute size and painful sting, has emerged as a significant threat in Mediterranean Europe. This widespread exotic species is well-known because of its invasive nature, impacting biodiversity, public health, and economic activities. Noted for the first time in Málaga (S Spain) in 2018, it has since expanded to other locations in the same province. Here we report the presence of *W. auropunctata* in La Marina (Alacant province, SE Spain), representing the fifth recorded population on the Iberian Peninsula and the first occurrence outside Málaga province. The species was found infesting a coastal area of approximately 5.1 hectares, with workers being observed in foraging trails across multiple surfaces and living in dense concentrations both indoors and outdoors. Exclusion of native ant species within the occupied area and direct engagement in combat with other species was observed. The population was discovered in September 2024; however, based on infestation density, spatial extent, and comparison with data of other Mediterranean exotic populations, the species likely established in the region prior to 2019. For the first time in Iberia, *W. auropunctata* was also detected in the coastal dunes adjacent to the infested urbanised area, highlighting its potential adaptability to dry Mediterranean habitats. The resilience of *W. auropunctata*, combined with its aggressive invasive traits and propensity to sting, underscores the urgent need for integrated management strategies to limit further expansion of the species in Iberia.

Key Words

Biological invasion, coastal ecosystems, exotic ants, Iberian Peninsula, Mediterranean ecosystem

Introduction

During the last decades, there has been an unprecedented increase in the number of introduced invasive exotic ants in Europe, which represent a serious threat not only to local ecosystems, but also to economic activities and public health (Schifani 2019; Demetriou et al. 2023; Schifani et al. 2024). Amongst them is one of the most alarming recent additions to the list of invasive alien ants: *Wasmannia auropunctata* (Roger, 1863), widely known as the little fire ant. The species has been noted to be amongst the 100 World's Worst Invasive Alien Species (Lowe et al. 2000), in view of the serious ecological and economic impacts. Native to the Neotropics, the natural range of *W. auropunctata* includes parts of South America, Central America, and the Caribbean (Wetterer 2013), but it has also established exotic populations in places such as the Galapagos Islands, West Africa, the Pacific Islands, and Florida (Causton et al. 2005; Wetterer 2013). *W. auropunctata* is easily identified within the Iberian

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myrmecological context by the small and monomorphic workers (approximately 1.5 millimetres in length), with a light brown to golden-brown body and a darker gaster (Fig. 1A–C). Other characteristics include antennae with 11 segments, with the two apicals forming a distinct club, head with bilateral sulcus to accommodate the scapes, mesosoma with long and sharp propodeal spines, truncated petiole in lateral view and body heavily sculptured. Queens are about 4.5 mm in size and generally darker compared to the workers (Montgomery et al. 2022).

The species shares most of the key invasive traits associated with other exotic ant species, including generalistic habits in both feeding and nesting, high colony mobility, polygynous societies, and strong interspecific aggression. All these factors enable *W. auropunctata* to successfully outcompete and eradicate native ants (Montgomery et al. 2022). In addition, its ability to prosper in both disturbed and natural habitats makes *W. auropunctata* a potentially serious problem for Mediterranean Europe. Negative consequences of the invasion of *W. auropunctata* have been documented worldwide. It is well-known that the species displaces native ants and other arthropods, reducing biodiversity and disrupting ecosystem dynamics, including pollination and seed dispersal (Clark et al. 1982; Horvitz and Schemske 1986). It also damages crops by fostering Homoptera agricultural pests (Delabie and Cazorla 1991; Fasi et al. 2013). Finally, it poses risks to human and animal health due to its painful sting and possibility of allergic reactions with severe effects such as leukomas (Rosselli and Wetterer 2017).

In Europe, its presence outdoors was first reported in Málaga province (SE Spain), where it is believed to have been present before 2013 (Espadaler et al. 2018). Since then, it has spread to other localities within the province (Pradera and Espadaler 2024). It has also been detected in France, where it has been present since at least 2018 (Blight et al. 2024), and more recently in Cyprus (Demetriou et al. 2022). Indoor populations or intercepted individuals, without possibility of outdoors establishment because of climatic conditions, have been reported in the United Kingdom (Donisthorpe 1908), Germany (Geiter et al. 2002) and the Netherlands (Boer and Vierbergen 2008). There is also a report of a single individual from an island in Italy (Jucker et al. 2008). Here, we report the recent finding of the fifth so far known population of *W. auropunctata* in Iberia and the first one outside the province of Málaga.

Material and methods

The initial observation of workers occurred in a detached house in La Marina (Alacant province, SE Spain) (approximate coordinates: 38°08'38.3"N, 0°38'30.5"W), which is surrounded by agricultural fields and neighbouring residences. La Marina is a coastal locality in the south-eastern Iberian Peninsula, with its urban and semi-urban core extending along a strip of coastal dunes. The region presents two distinct zones: the urbanised area and the coastal natural habitat, the latter mainly comprised by a dune system populated by pine trees. The urbanised zone includes buildings, businesses, and a significant portion of single-family homes with large yards and cultivated fields. The locality is a well-known tourist destination, with a great influx of tourists during summer.

The presence of *Wasmannia* Forel, 1893 was first noted in late September 2024 by the second author, a myrmecology enthusiast, who observed the recent appearance of yellowish ants in his kitchen (Fig. 1D). Noticing that their morphology differed from any known local species, he contacted the first author, who made a preliminary identification through photographs, noting that the species seemed to be indeed *W. auropunctata* due to its unique morphology within the Iberian context. As a result, on 10 October 2024, authors conducted a thorough visual inspection in different microhabitats of the area, carefully examining areas beneath stone and on tree trunks, human-made structures, and drainage openings to define the perimeter of the infestation. Surrounding properties, nearby parks and gardens, and the dune zone close to the urbanised area, were also inspected. We did not systematically search inside private properties. Additionally, an ant species survey was carried out to compare areas invaded by *W. auropunctata* with those free from its presence. Species identification in the laboratory was performed using the taxonomic keys by Bolton (1994) and Longino and Fernández (2007). The photographic material used for Fig. 1A–C consisted of a Sony A6000 camera equipped with a Plan APO 10X and a Nikon Mplan 20X ELWD microscope objectives. For the focus stacking technique, an electronic macro rail with a resolution < 1 µm per photo was used. Lighting was provided by two LED panels of adjustable intensity. Orthophotos used for the maps in Fig. 2 were obtained from the project PNOA (Plan Nacional de Ortofotografía Aérea), available under CC BY 4.0. Finally, the discovery was reported to the relevant authorities to enable the implementation of necessary control measures.

Results and discussion

The presence of *W. auropunctata* was detected through visual sampling over a large area of approximately 5.1 hectares (Fig. 2). The highest density of individuals was found around *Ficus carica* L. (Fig. 3A), even nesting within its fruits (Fig. 3B), and occasionally on other fruit trees such as *Ficus elastica* Roxb. ex Hornem and plants (*Hibiscus rosa-sinensis* L., *Ziziphus jujuba* Mill., etc.) where the ants were observed moving in conspicuous rows up the trunks, interacting with scales (Hemiptera, Coccidae), mainly *Parasaissetia nigra* (Nietner, 1861) and *Coccus hesperidum* (Linnaeus, 1758), from which they obtained carbohydrate-rich honeydew (Fig. 3C). *W. auropunctata* was also found within the urban area forming rows that extended over several metres, with nest

entrances along sidewalk edges, road margins, and building corners. Workers typically moved cautiously between cracks or using the protection of nearby edges whenever possible. Additionally, individuals were found under construction materials, in house patios, and indoors in at least one inspected property. A high density of workers was observed at feeding stations and water containers for stray cats (Fig. 3D), where they even established colonies beneath the containers (Fig. 3F). Despite extensive sampling, no queens were found in the excavated colonies, even in those with abundant workers and larvae. However, there is no doubt that the species is established and actively reproducing in the area. Their absence could be attributed to seasonal behaviour, as sampling was conducted at the onset of winter, and queens may have relocated deeper in the substrate.

Notably, *W. auropunctata* was also found in the dune area, a dry Mediterranean habitat mostly shaded by pine trees (*Pinus halepensis* Mill.) and with sandy substrate (Fig. 4A). The infested area in this habitat was approximately 0.4 ha, roughly 8% of the total infested surface. This area was apparently not connected to the main infested zone in the urban area. The small size of the workers made them particularly challenging to spot in this setting. However, they were detected when meticulously searching for individuals, digging beneath the superficial roots of pines and deep around the perimeters of stumps. Only one nest was located in the dunes, digging under a stump, where workers were seen expelling sand particles, forming a small mound of residual material on the surface. In the rest of the habitat, only sparse workers were found.

A marked difference was observed between the native species present in the area occupied by *W. auropunctata* and the infestation-free zone, highlighting the invasive behaviour of the species in La Marina, where we were even able to spot several attacks to native ants during our surveys in the area (Fig. 4), including a queen of *Crematogaster scutellaris* (Olivier, 1792) (Fig. 4C), workers of *Messor barbarus* (Linnaeus, 1767) and a colony of *Temnothorax racovitzai* (Bondroit, 1918). In areas occupied by *W. auropunctata*, including the urban environment and dune zone, only *Monomorium subopacum* (Smith, 1858), *Pheidole pallidula* (Nylander, 1849), and *Plagiolepis schmitzii* Forel, 1895 were occasionally found. In contrast, a variety of species were identified outside this zone: *Aphaenogaster iberica* Emery, 1908, *Camponotus foreli* Emery, 1881, *Camponotus lateralis* (Olivier, 1792), *Camponotus piceus* (Leach, 1825), *Camponotus ruber* Emery, 1925, *Camponotus sylvaticus* (Olivier, 1792), *Cardiocondyla mauritanica* Forel, 1890

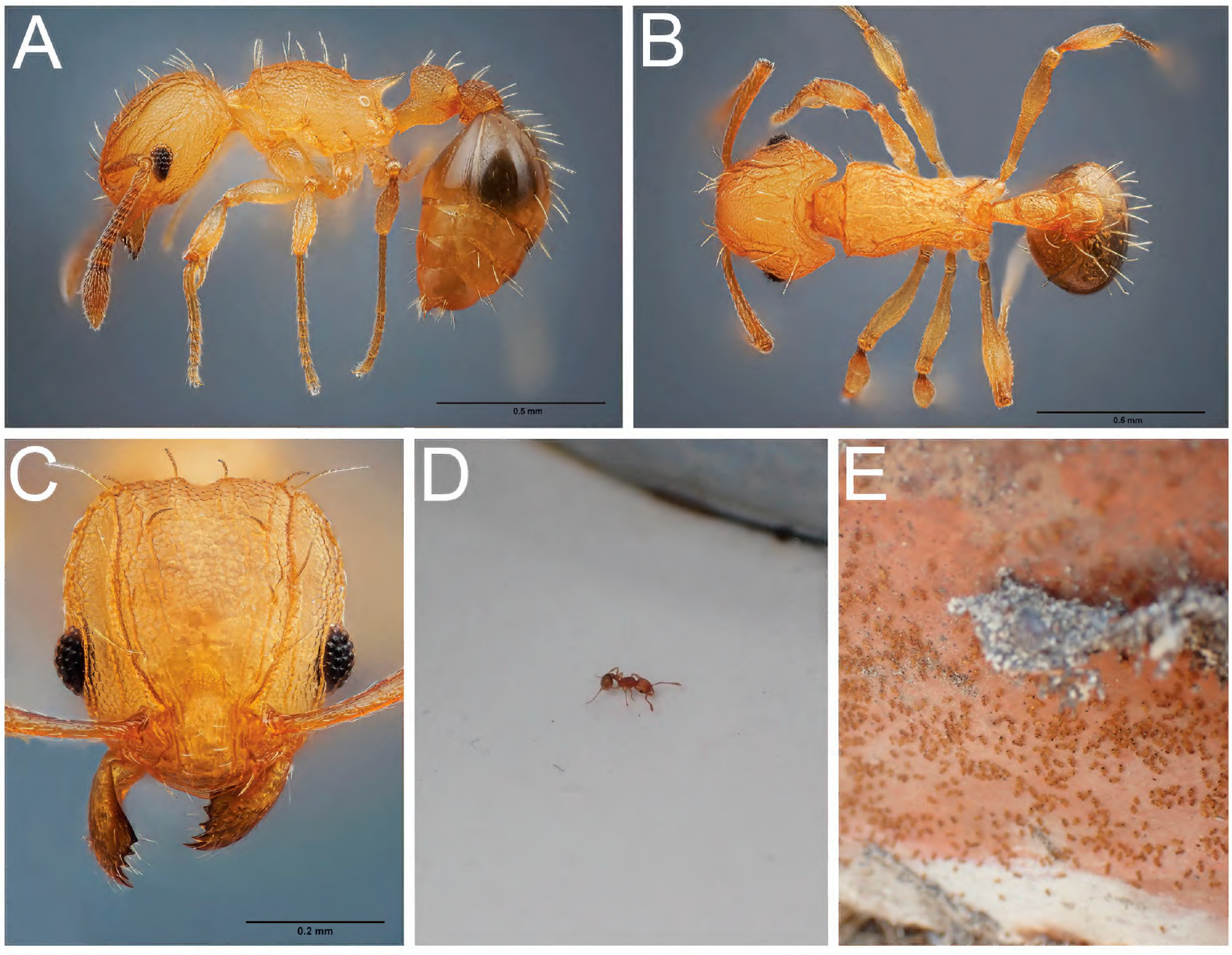

Figure 1. A, B, C. General habitus of the worker of *W. auropunctata* in lateral, dorsal and frontal views, respectively; **D.** Solitary worker foraging in the wash-basin of a home; **E.** Accumulation of workers beneath a pot in the garden of a property.

Figure 2. Location of La Marina within Iberia (top left), close-up view of the region (bottom left) and map of the extension of *W. auropunctata* in La Marina (right). The last shows main roads and human-made structures in grey, red dots for detected workers of *W. auropunctata* and occupied areas shaded in red. Note the two, well-separated infested areas in the urban and natural dune environments.

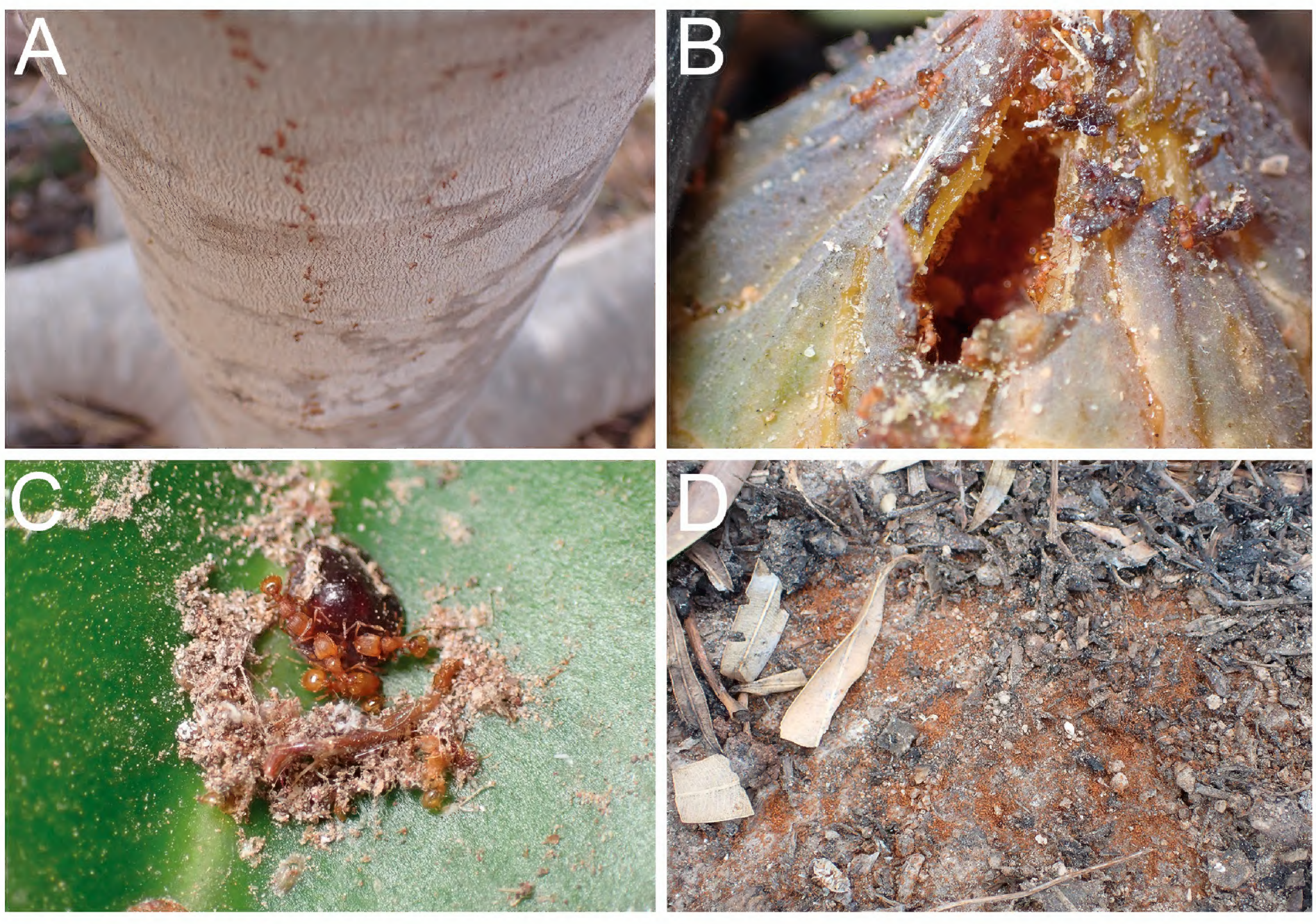

Figure 3. A. One of the many rows of *W. auropunctata* workers climbing a *F. carica*; **B.** Workers excavating and nesting inside a fruit of *F. carica*; **C.** Workers tending *P. nigra* on a big *F. elastica* tree; **D.** Huge densities of *W. auropunctata* workers and brood were revealed next and under improvised animal feeders for feral cats.

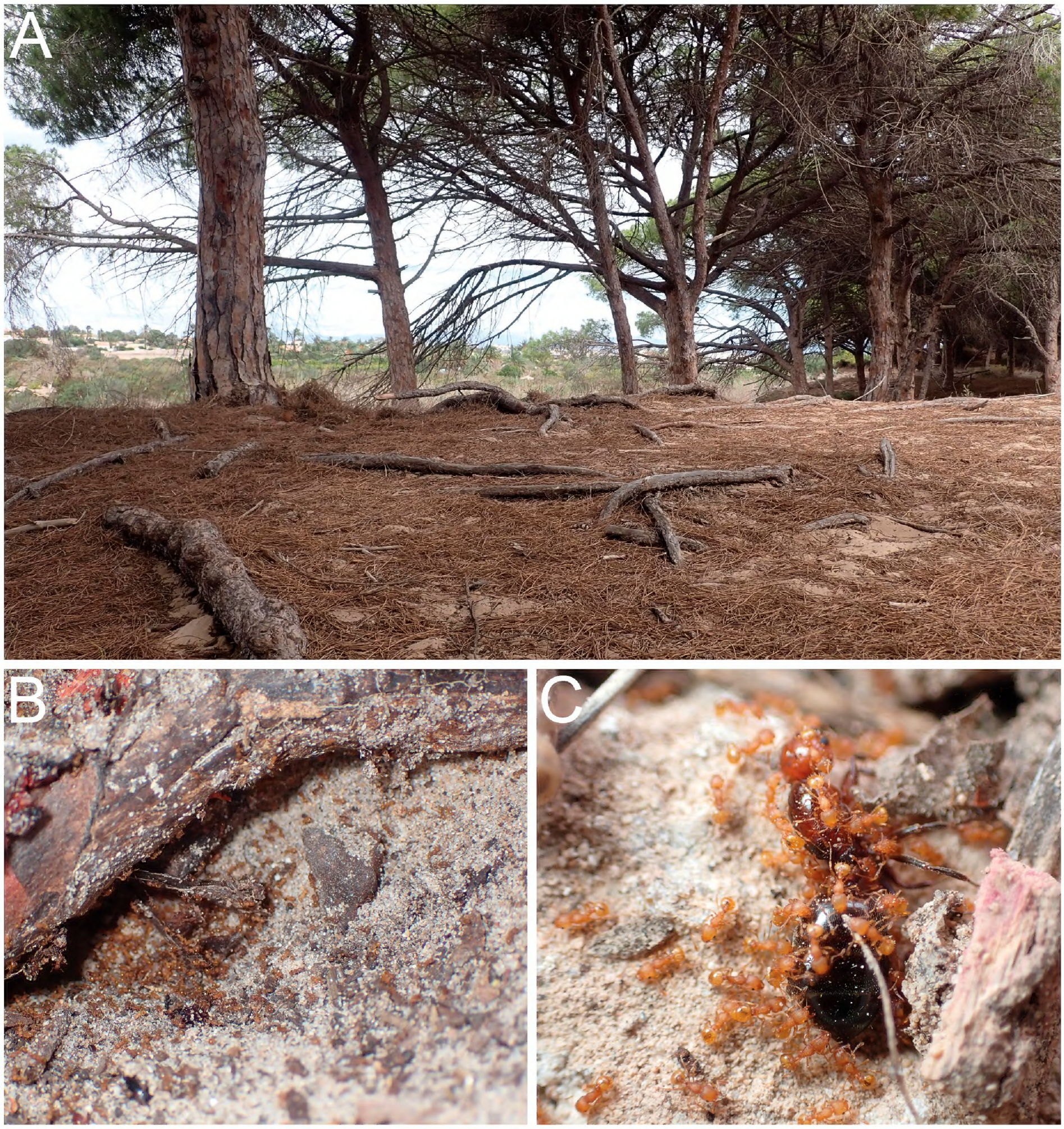

Figure 4. A. General view of the dune area with pines infested with *W. auropunctata*; **B.** Part of a nest under a superficial *P. halepensis* root; **C.** Several workers attacking a *C. scutellaris* female.

(exotic species), *Cardiocondyla obscurior* Wheeler, 1929 (exotic species), *Cataglyphis iberica* (Emery, 1906), *Colobopsis truncata* (Spinola, 1808), *Crematogaster auberti* Emery, 1869, *Crematogaster scutellaris*, *Lasius grandis* Forel, 1909, *Linepithema humile* (Mayr, 1868) (invasive exotic species), *Messor barbarus*, *Messor bouvieri* Bondroit, 1918, *Pheidole pallidula*, *Plagiolepis schmitzii*, *Tapinoma* sp. Foerster, 1850 (*nigerrimum* complex), *Temnothorax racovitzai*, and *Tetramorium immigrans* (Santschi, 1927) (exotic species).

Determining the precise timeline of *W. auropunctata* establishment in La Marina presents some challenges. A local resident reported noticing ant stings in June 2024, while the second author of this study first observed them in September 2024. In Málaga province, Espadaler et al. (2018) documented an infested area of 5.8 ha in 2018, an extension comparable to that of our study, and estimated its possible arrival at least five years earlier, before 2013. This population subsequently expanded to 9.9 ha in 2021 and reached 16 ha in 2023 (Pradera and Espadaler 2024). In France, Blight et al. (2024) reported an infested area of 1 ha in 2024 and sting reports dating back to 2019, suggesting an initial establishment at least five years prior. Based on these reports in the Mediterranean area, with similar climatic conditions to those of La Marina than to other tropical and subtropical regions of the world, along

with the extent of infestation and its high colony densities, it is likely that the species had settled in La Marina by 2019 or earlier, likely more than five years before our observations. However, in this study, we lack data on older local residents' complaints about ant stings to directly support the timeline of establishment.

The climate of La Marina is characterised by mild winters and hot summers, with clear seasonal temperature variations. The mean monthly minimum, mean, and maximum temperatures are 13.67 °C, 18.92 °C and 24.25 °C respectively (1992–2021). Mean annual precipitation is 298.7 mm (1990–2020). Compared to the first recorded Iberian population in Marbella (Málaga province), which has mean monthly minimum, mean, and maximum temperatures of 13.5 °C, 17.8 °C, and 22.2 °C, respectively, with an annual precipitation of 703 mm (Espadaler et al. 2018), this locality is slightly warmer and significantly drier.

In our case, it is difficult to determine the exact method of introduction of the species in La Marina. However, this species is known to spread globally via anthropogenic means, particularly through the movement of plant materials, vehicles, and construction elements. It is probable that the species arrived here also through these means.

Conclusion

W. auropunctata is one of the world's most widespread invasive species, mainly because of its huge adaptability across both disturbed and undisturbed habitats and ease of unintentional human-mediated translocation. This article discusses the discovery of the fifth known population of *W. auropunctata* in Iberia, marking the first record outside Málaga province. The species is established across an extensive urban and semi-urban area of the coastal locality of La Marina (Alacant province), covering approximately 5.1 hectares, and displays significant densities both indoors and outdoors. Part of the infestation is located in a dry, natural setting, an unusual environment for this exotic species. Here, the ants live under stumps and shallow roots, marking the first documented instance of *W. auropunctata* nesting in more naturalised, non-urban areas in Iberia. This behaviour underscores the species' remarkable resilience and potential for spreading across other similarly arid Mediterranean habitats.

With five established populations in Iberia, the region is currently leading *W. auropunctata*'s expansion in Europe (Espadaler et al. 2018; Espadaler et al. 2020; Pradera and Espadaler 2024). Although Wetterer and Porter (2003) did not foresee an expansion of this species into Mediterranean Europe, these new records suggest that further spread in this region is likely. Our findings highlight the urgent need to develop and implement management strategies that address both the ecological and socio-economic impacts in Iberia. Collaboration amongst scientists, policymakers, and local communities will be essential to mitigate the negative impacts of this species and to protect the biodiversity of affected ecosystems.

Author contributions

JA: Conceptualization, Methodology, Software, Investigation, Writing – Original draft, Writing – Review and Editing, Visualization, Supervision. EA: Methodology, Investigation, Writing – Original draft, Writing – Review and Editing. ÁR: Methodology, Investigation, Writing – Original draft, Writing – Review and Editing. PA: Methodology, Investigation, Writing – Original draft, Writing – Review and Editing.

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